Insect Fauna of Hen Manure.

BY J. F. ILLINGWORTH.

(Presented at the meeting of April 6, 1922.)

During 1916 the writer, while making some studies of the stick-tight flea (*Echidnophaga gallinacea* Westw.) upon poultry, became interested in the swarms of insects which were observed in and about the manure that had been removed from the hen-houses. In this instance, the droppings had been collected and stored in old kerosene tins, preparatory to placing on the garden. These stood in the open, so had collected considerable moisture from rains, etc., and in a few tins the contents had even become saturated. Yet conditions appeared to be ideal for the development of insects, for even these supersaturated contents were a writhing mass of larvae of various Diptera, etc., together with the various forms of predators and parasites that had gathered around to prey upon them.

Since all exact information of the breeding habits of insects is valuable for reference, the writer thought it well to record all of the organisms that came under these observations. Naturally with the Hawaiian fauna, the great majority of dung-feeding insects are Diptera. Twelve species of flies were bred out from this material. Of the natural enemies of these—predators and parasites—I was able to note fully twenty species.

DIPTERA REARED; GIVEN IN THE ORDER OF ABUNDANCE.

1. *Sarcophaga fuscicauda* Böttcher.—This species I found also in North Queensland, where it proved exceedingly troublesome about human habitations, breeding upon any available food or excrement. Its association with man in the tropics is almost as close as that of the house-fly, *Musca domestica* Linn., though it is more of an outdoor species, living primarily about camps, etc. Like the house-fly, too, this species is quick to follow along the lines of commerce, the indications being that it came to Hawaii either from Australia or from other Pacific countries to the west, during rather recent times. The earliest specimens in collections here bear date of 1905. Dr. R. R.

Parker identified this species for Mr. Timberlake early in 1919. I sent a lot of Sarcophagids from North Queensland to Parker, February 9, 1918, and he also found this species among them.

Even in the semi-liquid manure, the larvae appeared perfectly happy; yet, when full fed, they died if they were unable to migrate to a fairly dry situation.

2. *Musca domestica* Linn., the house-fly.

3. *Stomoxys calcitrans* Linn., the stable-fly.

4. *Ophyra nigra* Wied.—These shining black Anthomyids also appear to be closely associated with man in the tropics, for they are widely distributed. They are very abundant in Queensland, principally as carrion feeders; and are regarded as one of the sheep blow-flies.

The larvae have a characteristic smooth, shiny appearance, and the caudal spiracles are particularly small and brown in color. Unlike the house-fly and stable-fly, the larvae of this species were found to pupate right in the excessively moist manure, from which they were able to emerge successfully.

Mr. Frederick Knab of the United States Museum determined specimens for Mr. Swezey, early in 1916; and also determined a lot which I sent from the College of Hawaii about the same time. Later (March 22, 1918) Dr. Aldrich found that specimens, which were bred and collected in North Queensland, also belonged to this species. Described from China, and being widely distributed in the Orient, introduction to Hawaii was evidently through shipping. The earliest reference to the species here is probably that in the Fauna Hawaiiensis, where two females taken during 1893 and 1894 are placed in the genus *Hydrotaea* Desv. The earliest specimens that we find in collections here are dated Hawaii, February 28, 1905, taken by Terry.

5. *Fannia pusio* Wied.—The larvae of this smaller, omnivorous Anthomyid also swarmed in the semi-liquid manure; yet, like the Sarcophagid, I found that it was necessary for them to get a fairly dry place to pupate, in order to emerge successfully.

6. *Milichiella lacteipennis* Loew. — This tiny Agromyzid occurred in great swarms, with three other undetermined species, about the tins of manure. All three species were later bred out from the mass.

7. An undetermined Mycetophilid (No. 20) also bred out in considerable numbers. This is the tiny fly that is so troublesome, coming into houses to the lights, especially when one is reading in the evening. Their small size permits them to pass through ordinary mosquito screens.

8. *Lucilia sericata* Meig.—I was surprised to have this carrion-fly breed out, even in small numbers, from the hen manure; for knowing the habits of this species I naturally assumed that the numerous individuals swarmed about the manure-tins only to feed. This common English blow-fly has gradually extended its range round the world. It probably got to Hawaii some time about 1900, the first specimens in collections here being dated 1904, by Terry.

9. *Euxesta annonae* Fabr.—This well known Ortalid bred out of the manure in limited numbers. Though I frequently saw the adults sitting about on the surface while the mass was fermenting, I was not able to identify any of their young. The earliest Hawaiian record, that I have been able to locate, of this species, is in the Fauna Hawaiiensis, a female specimen taken in the Honolulu mountains, 1900.

Natural Enemies of Diptera Found in the Manure.

Predators were abundant all the time that the dipterous larvae were developing in the manure; on the other hand, parasites were little in evidence (due to their small size), yet they finally emerged in considerable numbers from the pupae of the flies.

Two species of earwigs were common during the earlier stages, *Euborellia annulipes* (Luc.) and *Spongolabis hawaiiensis* (Borm.). A few of a third, a small species, *Labia pilicornis* (Motsch.), were also captured.

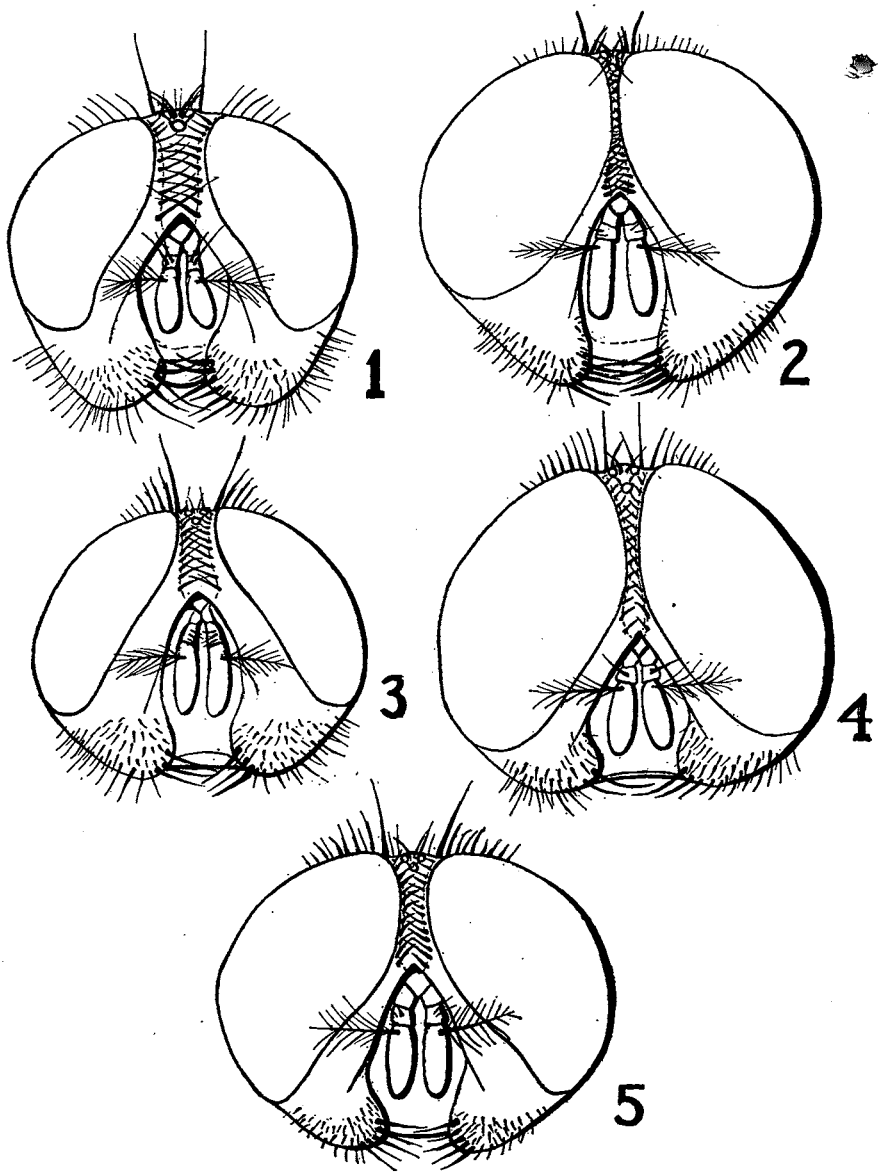
The common Hydrophilid, *Dactylospermum abdominale* (Fabr.), was active, and I also secured specimens of *Cryptopleurum minutum* Fabr. and another small undetermined species.

Four species of Staphylinids were abundant during the earlier part of the work, *Philonthus longicornis* Steph., which Mr. A. M. Lea of the South Australian Museum informs me is the correct name for our *P. scybalarius,* which is a synonym; *Philonthus discoideus* Grav.; a species of *Tachyporus;* and a small *Oxytelus* sp.

Ants swarmed over the surface of the manure and burrowed in where they found the mass dry enough, seeking both the eggs and the larvae of the flies. *Pheidole megacephala* Fabr. proved most useful in this work, attacking even the full grown maggots; *Ponera perkinsi* Forel was also in evidence.

Mites gave considerable distress to the flies when they began to emerge, their bodies being frequently so covered with these predators that they could scarcely move about.

At least seven species of hymenopterous parasites were secured, as they emerged from the various dipterous pupae. The large Cynipid, *Eucoila impatiens* Say, apparently came only from the puparia of the Sarcophagid; Spalangiids were very abundant, at least four species being present; *Spalangia cameroni* Perk., *S. philippinensis* Full., *S. simplex* Perk., and one that is apparently new. Of the remaining, there were two species of *Diapria* and a few *Pachycrepoideus dubius* Ashm. The determinations of these Hymenoptera were kindly supplied by Mr. Fullaway and Mr. Timberlake; they are all fairly recent introductions.



House Flies.

House-Flies.

BY J. F. ILLINGWORTH.

(Presented at the meeting of November 2, 1922.)

Attempting to straighten out the terminology of our Muscoid flies, particularly those records of specimens not recognized in collections here, some interesting observations have come to my notice. Apparently the common house-fly, *Musca domestica* Linn. of Europe, North America, etc., does not occur here, at least not in its typical form. Collecting thousands of flies, during the past decade, has failed to disclose a single specimen.

I have on exhibition typical *domestica* from San Francisco and Mojave Desert, Cal.; Ithaca, N. Y.; and Sydney, Australia. It is to be noted that, in comparison with these, where the eyes of the males are well separated, most of the Hawaiian specimens have the eyes, in that sex, almost contiguous, with some variations.

There is a record of *Musca flavinervis* Thomson in the Fauna Hawaiiensis, which has troubled me, since no specimens have been recognized in collections here. During the voyage of the

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PLATE IX.

FACE VIEW OF MALE HOUSE-FLIES.
(Semi-diagrammatic, Camera Lucida sketches.)

EXOTICS.

Fig. 1. Typical *Musca domestica* Linn., from Mojave Desert, Cal., 1916, Illingworth collector.

Fig. 2. Typical *Musca flavinervis* Thomson, from Cape Town, South Africa, Bridwell collector.

HAWAIIAN VARIETIES.

Fig. 3. Nearest approach to *Musca domestica* of all the flies taken. Oahu, January 2, 1914, Illingworth collector.

Fig. 4. Nearest approach to *Musca flavinervis* of all the flies taken. Puna, Hawaii, March 13, 1922, Swezey collector.

Fig. 5. An intermediate form which is representative of the Hawaiian house-flies. University of Hawaii Farm, October 17, 1922. Illingworth collector.

Eugenia, 1851-3, the specimens which Thomson described were collected on Ross Island, on the coast of China (?), and he further stated that a variety was taken at Honolulu. I have typical specimens, which I take to be this species, from Cape Town, collected by Bridwell, and it is very interesting to note that the common house-flies of Hawaii compare more closely with these than with specimens of the true *domestica*. It will further be seen that there is some variation in the width of the space between the eyes of the males in the Hawaiian flies, just as one might expect. Hawaii, being the "melting pot of the Pacific," flies coming from the East and from the West, along the lines of commerce, have met and mingled here, with the result that our variety of the common house-fly is not typical of either species, but rather a hybrid.

The Little House-Fly.

Fannia canicularis Linn. is another species which was recorded from Hawaii,[1] two specimens having been sent from that island to Dr. Howard in 1901. Yet no further specimens had been placed in collections here. During my recent visit to the large island (June, 1922) I found that this was the most abundant species, literally swarming in the hotel where I stopped in Waimea. Hence, it would appear that we overlook the commonest things in our collecting, by taking too much for granted.

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[1] Proc. Ent. Soc. Wash., IV, p. 490, 1901.